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No. 94-

In the Supreme Court of the United States

OCTOBER TERM, 1994

CPC INTERNATIONAL INC.,
Petitioner,

v.

ARCHER DANIELS MIDLAND COMPANY,
Respondent.

Petition for a Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

PETITION FOR A WRIT OF CERTIORARI

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December 21, 1994

QUESTIONS PRESENTED

Section 112 of the Patent Act of 1952, 35 U.S.C. § 112, requires that a patent application "set forth the best mode contemplated by the inventor of carrying out his invention." The questions presented are:

1. Whether a patent may be declared invalid for failure to disclose the "best mode contemplated by the inventor" when the undisclosed mode was not contemplated by or known to the inventor, but consisted of information developed subsequent to the invention by the inventor's corporate assignee.

2. Whether the Federal Circuit erred in affirming without opinion, under its Circuit Rule 36, a district court decision that rested on an interpretation of the statutory best mode requirement that was contrary to prior holdings of the Federal Circuit and the Fifth Circuit.

PARTIES TO THE PROCEEDING

Petitioner is CPC International Inc. Pursuant to Supreme Court Rule 29.1, petitioner states that it has no parent company and that its only subsidiaries (other than wholly owned subsidiaries) are Corn Products Co. Ltd. of India and Rafhan Maize Products Co. Ltd.

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PETITION FOR A WRIT OF CERTIORARI

CPC International Inc. ("CPC") respectfully petitions for a writ of certiorari to review the judgment of the United States Court of Appeals for the Federal Circuit.

OPINIONS BELOW

The Federal Circuit's summary affirmance is listed at 31 F.3d 1176 (1994) (table) and is reproduced in the Appendix ("App.") at 1a. The order of the Federal Circuit denying petitioner's petition for rehearing and suggestion for rehearing *en banc* is unpublished and is reproduced at App. 2a. The opinion of the United States District Court for the District of Delaware is published at 831 F. Supp. 1091 (D. Del. 1993) and is reproduced at App. 3a-45a.

JURISDICTION

The district court had jurisdiction under 28 U.S.C. §§ 1331 and 1338(a). The judgment of the court of appeals was entered on July 11, 1994. The order denying the petition for rehearing and suggestion for rehearing *en*

banc was entered on September 22, 1994. This court has jurisdiction to issue the writ under 28 U.S.C. § 1254(1).

STATUTE AND RULE INVOLVED

Section 112 of the Patent Act of 1952, 35 U.S.C. § 112, provides in pertinent part:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Rule 36 of the United States Court of Appeals for the Federal Circuit provides:

> The court may enter a judgment of affirmance without opinion, citing this rule, when it determines that any of the following circumstances exist:
>
> (a) the judgment, decision or order of the trial court appealed from is based on findings that are not clearly erroneous;
>
> (b) the evidence in support of a jury verdict is sufficient;
>
> (c) summary judgment, directed verdict, or judgment on the pleadings is supported by the record;
>
> (d) the decision of an administrative agency warrants affirmance under the standard of review in the statute authorizing the petition for review; or
>
> (e) a judgment or decision has been entered without an error of law;
>
> and an opinion would have no precedential value.

STATEMENT

A patent application must "set forth the best mode contemplated by the inventor of carrying out his invention." 35 U.S.C. § 112. In this case, the district court invalidated a patent (which it found otherwise valid and infringed) on the ground that the patent application had failed to set forth information the court found was *not* known to the inventor but was known to his corporate assignee, which assisted in preparing the patent application. This holding was contrary to prior Federal Circuit and Fifth Circuit precedent. Nevertheless, the Federal Circuit affirmed the district court's ruling, without opinion, under Fed. Cir. R. 36(e), which permits such unexplained affirmance of a decision "entered without an error of law."

The Invention

The inventor, Larry W. Edwards, an employee of CPC, invented a continuous process for making a sugar that was a significant improvement over the "batch" process previously used. Edwards discovered that, by agitating a continuously fed solution of monohydrate dextrose at high speed, he could reduce the "boundary layer" between the crystals being formed and the surrounding solution so as to produce sugar crystals on a continuous basis. The older "batch" method for crystallizing dextrose (also known as glucose) was not only slower but more expensive and created less uniform crystals. App. 8a.

Edwards completed a report to CPC on his invention in April 1977. He summarized his invention and stated that, in the ten-gallon vessel he had used, the optimum agitator (or "tip") speed for crystallization was about 60 cm/sec. He added that, in this vessel, higher speeds did not increase the rate of crystal growth but had the disadvantage of producing smaller crystals by attrition. He suggested that CPC scale up his laboratory work to larger vessels. Shortly after submitting the report, Edwards was transferred to another position within CPC, and he did no further work on his crystallization process. App. 10a-12a.

In 1979, CPC did scale-up work on Edwards' invention with the help of an outside consultant, the Swenson Process Equipment Company ("Swenson"). In place of the ten-gallon vessel with which Edwards had made his invention, Swenson used a larger crystallization vessel that held 240 gallons. Swenson recognized that the larger vessel would require higher tip speeds to maintain the same degree of agitation that had been observed by Edwards in his ten-gallon tank. Swenson tested the process in the larger vessel at tip speeds of 516, 548 and 588 cm/sec. App. 12a.

An application for a patent on Edwards' continuous crystallization process was filed on December 17, 1980. The application was prepared primarily by Edwards' employer, CPC, to which he had assigned his rights, and it was signed by Edwards, as inventor. App. 13a.

The application contained a complete description and data summary of Edwards' work. It also noted that "[t]hrough further testing it has been found that tip speeds in the range of 300-600 cm/sec offer a reasonable compromise" with regard to the rate of crystal growth, size, and cost-efficient agitator design. App. 13a. The application did not, however, disclose information relating to scale-up, generated in the Swenson work, with which Edwards, the inventor, was not familiar.. App. 16a.

Two years later, on November 2, 1982, the U.S. Patent and Trademark Office issued to CPC "as the assignee of inventor Larry W. Edwards, U.S. Patent No. 4,357,172, titled 'Process for Continuous Crystallization of Alpha Monohydrate Dextrose Utilizing High Agitation' " (the "Edwards Patent"). App. 20a.

Proceedings Below

In 1988, Archer Daniels Midland Company ("ADM"), which had used Swenson as a consultant after Swenson's work with CPC, began manufacturing monohydrate dex-

trose on a continuous basis in four crystallizers. CPC brought suit against ADM in the United States District Court for the District of Delaware, alleging that ADM had infringed the Edwards Patent and seeking damages and injunctive relief. ADM denied infringement and alleged that the Edwards Patent was invalid and unenforceable. ADM also counterclaimed for damages on antitrust and unfair competition theories.

The district court found that the process used in one of ADM's four crystallizers infringed the Edwards Patent. App. 23a. The court also rejected all but one of ADM's numerous defenses to the validity of the patent, concluding, *inter alia*, that the patent was not invalid on grounds of anticipation, obviousness, enablement or indefiniteness. App. 31a-37a, 41a-42a. In particular, the district court concluded that Edwards was the sole inventor and rejected ADM's claim that Swenson employees or additional CPC employees should have been listed as co-inventors. App. 42a-43a.

The district court ruled, however, that the Edwards Patent was invalid for failure to comply with the best mode requirement of 35 U.S.C. § 112. Specifically, the court objected that the application did not include data generated during the Swenson scale-up work after the completion of Edwards' invention: "By including a description of Edwards' work and failing to describe the Swenson scale-up, CPC intentionally failed to disclose what it knew at the time was the best mode for implementing what it intended the invention to be, a commercial process." App. 40a. According to the district court, CPC was under an obligation to either "mention the Swenson work, disclose the Swenson data, or offer assistance as to where such information may be found." App. 41a.

The district court acknowledged that Edwards was the only inventor (App. 42a-43a), and it noted that "[t]here

is no evidence to suggest that Edwards . . . was even aware of the Swenson work." App. 38a. The court reasoned, however, that because of CPC's involvement in the preparation and filing of the application, "the purpose of the statute would not be served merely by looking to Edwards' intent at the time the application was filed." App. 38a. Guided by its inference as to the statute's purpose rather than the statutory text, and without attempting to distinguish prior cases stating that only the inventor's knowledge is relevant under Section 112, the court concluded that it must "instead consider the information available to both Edwards and his agent, CPC," which included the Swenson work. App. 38a.

CPC appealed the judgment of invalidity, arguing that the district court had seriously misinterpreted Section 112 and that its decision conflicted with a prior decision of the Federal Circuit, *Texas Instruments Inc. v. U.S.I.T.C.*, 871 F.2d 1054 (Fed. Cir. 1989), and a prior decision of the Fifth Circuit, *Studiengesellschaft Kohle mbH v. Eastman Kodak Co.*, 616 F.2d 1315 (5th Cir.), *cert. denied*, 449 U.S. 1014 (1980). ADM cross-appealed from the district court's findings of infringement and its rejection of ADM's other defenses.[1]

The court of appeals affirmed without opinion. Its decision reads in its entirety: "Affirmed. *See* Fed. Cir. R. 36." App. 1a. The court of appeals offered no further explanation of its decision, but it could not have affirmed under Rule 36 unless it had "determine[d] that [the district court's] . . . decision has been entered without an error of law . . . ."[2]

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[1] CPC also appealed from the district court's ruling that three other ADM processes did not infringe the Edwards Patent. CPC does not challenge the court of appeals' affirmance of that ruling in this Court.

[2] Fed. Cir. R. 36 provides in part that the court "may enter a judgment of affirmance without opinion, citing this rule, when it

CPC petitioned for rehearing and suggested that the Federal Circuit rehear the case *en banc*. CPC noted that the Federal Circuit's affirmance of the district court's interpretation of Section 112 conflicted with earlier decisions of the Federal Circuit and the Fifth Circuit, causing confusion on an important point of law that should be discussed in a full opinion. The Federal Circuit Bar Association filed an amicus brief supporting CPC's petition. The Bar Association argued that "the best mode issue raised in this case is important" (Br. 2, 8) and that "[i]t is [now] an unsettled issue of law whether the best mode issue applies to the named inventors only, as suggested in *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1535 (Fed. Cir. 1987), or whether it extends to the assignee as well, as the district court held in this case." Br. 2. The Bar Association also argued that the court should reconsider the appropriateness of affirming without explanation under Rule 36, where the decision being affirmed conflicted with prior circuit precedent on an important issue.

The Federal Circuit denied rehearing, with Judge Rich not participating. Judge Newman, dissenting, voted to rehear the case *en banc*. App. 2a.

REASONS FOR GRANTING THE PETITION

This case presents a straightforward and important question of statutory interpretation: Does the phrase "best mode contemplated by the inventor" include information not known to the inventor but known to his corporate assignee, merely because the assignee assists the inventor in preparing the patent application? The answer given by the courts below conflicts with prior decisions of the Federal Circuit and the Fifth Circuit, and it contravenes both the statutory language and sound policy. The Federal

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determines that any of the following [five] specified circumstances exist." None of the other four circumstances, *see* p. 2, *supra*, could conceivably provide a basis for affirmance in this case.

Circuit's disposition of this case under its Rule 36 was particularly inappropriate, because that court was necessarily affirming as "without an error of law" a district court decision that conflicted with its own prior views on this important question.

I. THE QUESTION PRESENTED HAS IMPORTANT PRACTICAL CONSEQUENCES.

The factual context in which the "best mode" issue arose here is commonplace. The inventor and formal applicant for the patent is (and generally must be) a natural person: under the patent law, "only natural persons can be 'inventors,' "[3] and the inventor himself generally must apply for the patent.[4] But the inventor is an employee of a large manufacturing corporation that has supported his work, received an assignment of the invention, done additional work to assess the commercial usefulness of the invention, and substantially assisted the inventor in preparing his patent application.[5]

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[3] *Beech Aircraft Corp. v. EDO Corp.*, 990 F.2d 1237, 1248 & n.23 (Fed. Cir. 1993); *see also*, Steven Cherensky, Comment, *A Penny for Their Thoughts: Employee-Inventors, Preinvention Assignment Agreements, Property and Personhood*, 81 CAL. L. REV. 597, 603 (1993) ("Corporations and other non-natural persons cannot be inventors under the Patent Code.").

[4] *See* 35 U.S.C. § 111 ("Application for patent shall be made, or authorized to be made, by the inventor, except as otherwise provided in this title . . . ."). There are exceptions when an inventor dies before filing, *id.* at § 117, or "refuses to execute an application for patent, or cannot be found or reached after diligent effort." *Id.* at § 118.

[5] The great majority of inventions that receive U.S. patents—between 80 and 90 percent—are developed by corporate employees who assign the patent rights to their employers that have underwritten the research costs. *See* Cherensky, *supra*, at 602 n.15. This Court has considered several cases involving patents assigned by inventors to their corporate employers. *See, e.g., Diamond v. Chakrabarty*, 447 U.S. 303 (1980); *Sakraida v. AG Pro, Inc.*, 425 U.S. 273 (1976).

In that common situation, it makes a large difference whether a patent application need describe only the inventor's contemplations as to use, or must describe the employer's additional work looking toward commercialization, even if that work is not part of the invention, occurs at a later time, and is not known to the inventor. That question might have been thought settled by the statutory language and prior decisions, but the decision below has reopened it, creating uncertainty at the patent application stage and an opportunity for infringer defendants to attempt to invalidate patents by uncovering commercialization studies not disclosed in the application.

If the statute means what it says, preparers of patent applications need only determine and set forth the knowledge of one or more individual inventors. If it means what the courts below have held in this case, preparers must—at the risk of later invalidation—search out and set forth all other work done at the corporation that looks toward the implementation of the inventor's discovery.[6]

The interpretation of Section 112 given below would also affect the course and outcome of a substantial amount of patent litigation. Failure to set forth the "best mode" is a very common defense to claims of infringement.[7] The

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[6] In the case of a multinational, multiproduct company like CPC, the effort of preparing a patent application (and the length of the application itself) would often be substantially greater. The district court did not suggest that the amount of disclosure required is defined by, or limited to, the information known to the attorneys or other individuals who actually prepare the application; the extent of their personal knowledge has only an incidental relationship to the "contemplations" of either the inventor or his assignee. If, as the district court held, it is the assignee's contemplations that count, there is no safe stopping place short of searching out and disclosing all work done, at any location, by any corporate personnel or by consultants hired by the corporation who may have heard of the discovery and considered ways to implement it.

[7] "The best mode requirement is rapidly becoming the defense of choice among patent infringement litigants, and at the present pace

decision below would open up to discovery all of the corporate employer's work relating to potential uses of its employee's invention, and it would broaden the defense to include failure to set forth any such information found to fall within the (already vague [8]) contours of "best mode." It matters to both patent applicants and patent litigants whether the statute or the courts below are correct. That is why the Federal Circuit Bar Association told the court of appeals that "th[e] particular issue [in this case] is important to patent owners and to the bar." Br. 9.

II. THE LOWER COURTS' INTERPRETATION OF SECTION 112 CONFLICTS WITH DECISIONS OF THE FEDERAL AND THE FIFTH CIRCUIT COURTS OF APPEALS.

The decision below is in direct conflict with *Texas Instruments*, *supra*, and *Kohle*, *supra*. Both of these cases held that only the inventor's knowledge—not that of his assignee, other employees of the same company, or any other party—is relevant to the best mode analysis.

Texas Instruments involved a dispute over the adequacy of disclosure of the best mode of boosting voltage

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of litigation, best mode violations will be the basis for invalidation of many claims." Christopher S. Marchese, *Promoting the Progress of the Useful Arts by Narrowing Best Mode Disclosure Requirements in Patent Law*, 54 U. PITT. L. REV. 589, 614 (1993); *see also id* at 634 ("The best mode requirement, which is a factor in determining the scope of disclosure compelled by the patent laws, has produced a substantial and escalating amount of litigation in the past twenty-five years."); David J. Weitz, *The Biological Deposit Requirement: A Means fo Assuring Adequate Disclosure*, 8 HIGH TECH. L.J. 275, 282 (1993) ("[T]he best-mode requirement has become a recurrent issue in assessing patent validity.").

[8] "[J]ust how broadly the best mode requirement sweeps . . . is a matter of confusion and dispute." Christopher S. Marchese, *Confusion, Uncertainty, and the Best Mode Requirement*, 2 FED. CIR. B.J. 1, 2 (1992).

on certain computer components ("DRAMs") invented by an employee of Texas Instruments. Prior to the filing of the patent application, the company had developed a better means of boosting voltage for use in commercial production, but the inventor did not know of this mode. Another company, Samsung, challenged the patent, owned by Texas Instruments through assignment, on the ground that the patent application failed to disclose this better mode. The court rejected this contention as a matter of law:

> The fact that Texas Instruments may have manufactured a DRAM containing a different or better form of boosting means is not pertinent to whether the specification disclosed "the best mode contemplated by the inventor [of] carrying out his invention." The ALJ found that "[t]he record does not disclose that the applicant knew of or concealed a better mode than he disclosed" . . . . The finding is supported by substantial evidence and is dispositive of Samsung's best mode argument.

871 F.2d at 1061 (citations omitted). *Texas Instruments* thus squarely held that it is not a violation of the best mode requirement to fail to disclose a mode known to the inventor's assignee at the time the patent application is filed, if the inventor himself does not know of the mode.

In *Kohle*, the Fifth Circuit was equally clear that the best mode requirement focuses on the inventor's knowledge: "Even if there is a better method, the failure to disclose it will not invalidate the patent if the inventor does not know of it or does not appreciate that it is the best method." 616 F.2d at 1340; *cf. Aktiebolaget Karlstads Mekaniska Werkstad v. U.S.I.T.C.*, 705 F.2d 1565, 1574 (Fed. Cir. 1983) (holding, conversely, that a best mode developed by a co-worker of the inventor must be disclosed *if known to the inventor*).

District courts have followed the decisions of the circuit courts in *Texas Instruments* and *Kohle*. *See Glaxo, Inc. v. Novopharm Ltd.*, 830 F. Supp. 871, 882 (E.D.N.C. 1993)

("The statute refers only to the knowledge of the inventor, however, 35 U.S.C. § 112, and the holding of the Federal Circuit in the *Texas Instruments* case does not permit using imputed knowledge to meet the [best mode] requirement."), *appeal pending*, No. 94-1026 (Fed. Cir. 1994); *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 722 F. Supp. 595, 604-05 (N.D. Cal. 1989) ("[*Kohle*] set forth the concerns repeatedly expressed by the courts in reviewing the best mode disclosures of a patent," namely that even if an assignee develops a better mode "the question before the Court is whether [the inventor] held that same belief."), *aff'd*, 909 F.2d 1464 (Fed. Cir. 1990). The decision below in this case conflicts with all of these decisions.

III. THE LOWER COURTS' INTERPRETATION OF THE BEST MODE REQUIREMENT IS INCONSISTENT WITH THE PLAIN LANGUAGE OF SECTION 112 AND WRONG.

Where a statute has a plain and unambiguous meaning, that meaning controls. *See, e.g., Mansell v. Mansell*, 490 U.S. 581, 592 (1989); *Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 837, 842-43 (1984). In this case, the statutory language is unusually free of ambiguity. "Inventor" is a term of plain meaning used consistently throughout the Patent Act; it refers to one or more natural persons who have made an invention, and it does not include a corporation to which the inventor has assigned his invention.[9] And as the district court squarely held, the only inventor here was Edwards. App. 42a-43a.

The district court said that one quid pro quo for the grant of a patent is the disclosure of the best mode of

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[9] On the contrary, the Act treats "the inventor" and "the assignee" as distinct legal actors. *Cf.* 35 U.S.C. § 111 ("Application for patent shall be made, or authorized to be made, by the inventor, except as otherwise provided in this title . . . ."); *id.* at § 152 ("Patents may be granted to the assignee of the inventor . . . upon the application made and the specification sworn to by the inventor").

carrying out the invention, and that therefore "the purpose of the statute would not be served merely by looking to Edwards' intent . . . ." App. 38a. But it was error to conclude that the "purpose" of the statute required disclosures plainly not required by its text. The patent law does indeed strike a bargain, but it is a bargain between society and the inventor—the right to exclude others for "limited Times" in return for *his* knowledge—not a bargain between society and his assignee.

The inventor's assignment of his right is a matter of private contract outside the patent law, in which the inventor presumably receives the value of his invention. The assignee, having paid that value to the inventor, does not have any further debt to society. The statute imposes no disclosure obligation on assignees, whether or not they assist in preparing patent applications, and it makes no sense to conclude that the scope of the inventor's obligation is fundamentally altered because he uses his assignee to help him in preparing his application.

The courts below should not have attempted to enlarge the bargain to include information that was not part of the invention and was not known to the inventor. As this Court has admonished, "courts 'should not read into the patent laws limitations and conditions which the legislature has not expressed.'" *Diamond v. Chakrabarty*, 447 U.S. 303, 308 (1980) (quoting *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 199 (1933)).[10]

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[10] *See also Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417, 429 (1984) ("As the text of the Constitution makes plain, it is Congress that has been assigned the task of defining the scope of the limited monopoly that should be granted . . . to inventors."); *Sears, Roebuck & Co. v. Stiffel Co.*, 376 U.S. 225, 229 (1964) ("Congress in 1790 enacted the first federal patent and copyright law, 1 Stat. 109, and ever since that time has fixed the conditions upon which patents and copyrights shall be granted.").

IV. THE FEDERAL CIRCUIT SHOULD NOT HAVE DISPOSED OF THIS CASE UNDER ITS CIRCUIT RULE 36.

Finally, as the Federal Circuit Bar Association suggested to the Federal Circuit, this was not an appropriate case to dispose of without explanation under Rule 36.[11] The district court's decision was squarely based on its interpretation of Section 112. That decision could not have been affirmed under Rule 36 unless the Federal Circuit agreed with the district court's interpretation. But that interpretation was plainly in conflict with Federal Circuit precedent (as well as other precedent) on an issue of great importance. Whether or not it meant to be adopting a new rule, the court of appeals should have explained its affirmance so as to provide guidance to the district courts and to patent owners on a controversial and significant issue.[12]

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[11] The Federal Circuit adopted Rule 36 in 1989 and has since made steadily increasing use of the rule to affirm lower court opinions without explanation. *See* Jennifer A. Tegfeldt, *A Few Practical Considerations in Appeals Before the Federal Circuit*, 3 FED. CIR. B.J. 237, 248-49 (1993). Over the past five years, the number of Rule 36 opinions issued by the Federal Circuit has risen dramatically: in the first six months of 1994, 44% of the Federal Circuit's case dispositions (excluding cases in which the United States is a party) were by unexplained summary affirmances under Rule 36. *See* Fed. Cir. Bar Ass'n Br. 6.

Commentators have widely criticized this practice of unexplained affirmances in general, *see* William L. Reynolds & William M. Richman, *The Non-Precedential Precedent—Limited Publication and No-Citation Rules in the United States Courts of Appeals*, 78 COLUM. L. REV. 1167 (1978), and the Federal Circuit's increasingly heavy reliance on it in particular. *See* Nathan Dodell, *On Wanting to Know Why*, 2 FED. CIR. B.J. 465 (1992).

[12] This Court has stressed the need for the Federal Circuit to consider, and definitively settle, patent law issues. *See Cardinal Chemical Co. v. Morton Int'l, Inc.*, 113 S. Ct. 1967, 1971 (1993) ("Because the Federal Circuit has exclusive jurisdiction over appeals from all United States District Courts in patent litigation, the rule that it applie[s] . . . is a matter of special importance to the entire Nation.").

CONCLUSION

For these reasons, the petition for writ of certiorari should be granted.

Respectfully submitted,

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December 21, 1994

APPENDIX

APPENDIX

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 94-1045, 94-1060

CPC INTERNATIONAL INC.,
Plaintiff-Appellant,
v.

ARCHER DANIELS MIDLAND COMPANY,
Defendant/Cross-Appellant.

On Appeal from the United States
District Court of Delaware,
in Case No(s). 91-CV-452

July 11, 1994

Per Curiam (NIES, Circuit Judge, COWEN, Senior Circuit Judge, and RADER, Circuit Judge):

AFFIRMED. *See* Fed. Cir. R. 36.

UNITED STATES COURT OF APPEALS
FEDERAL CIRCUIT

Nos. 94-1045, 94-1060

CPC INTERNATIONAL INC.,
Plaintiff-Appellant,

v.

ARCHER DANIELS MIDLAND COMPANY,
Defendant/Cross-Appellant.

Sept. 22, 1994

ORDER

A combined petition for rehearing and suggestion for rehearing in banc having been filed by the appellant, and brief of amicus Federal Circuit Bar Association having also been filed, and a response thereto having been invited by the court and filed by the cross-appellant, and the petition for rehearing having been referred to the panel that heard the appeal, and thereafter the suggestion for rehearing in banc, the response and amicus brief having been referred to the circuit judges who are in regular service,

Upon consideration thereof, it is ordered that the petition for rehearing be, and the same hereby is, denied and it is further ordered that the suggestion for rehearing in banc be, and the same hereby is, declined.

The mandate of the court will issue on September 29, 1994.

Circuit Judge NEWMAN would rehear the appeal in banc. Circuit Judge RICH did not participate in the vote.

UNITED STATES DISTRICT COURT
D. DELAWARE

Civ. A. No. 91-452-RRM

CPC INTERNATIONAL INC.,
Plaintiff,

v.

ARCHER DANIELS MIDLAND COMPANY,
Defendant.

Aug. 20, 1993

OPINION

McKELVIE, District Judge.

INTRODUCTION

This is a patent case. CPC International Inc. ("CPC") is the owner of U.S. Patent No. 4,357,172, which is directed to a continuous process for the crystallization of alpha monohydrate dextrose. CPC alleges that Archer Daniels Midland Company ("ADM") is infringing the patent in operating four draft-tube crystallizers at its facility in Clinton, Iowa. ADM has denied infringement, alleged the patent is invalid and unenforceable, and counterclaimed for damages, alleging that in asserting these claims CPC has violated state and federal antitrust laws and is guilty of unfair competition.

Pursuant to an agreement between the parties, the infringement, invalidity and unenforceability issues were

tried to the Court in February of this year. This is the Court's post-trial decision on those issues.

FACTS

I. *The Field of the Invention and the Plaintiff's Patent*

A. *The Field of the Invention: Crystallization of Dextrose*

Food processors and soft drink manufacturers often sweeten their products with glucose, a type of sugar. Glucose, also known as dextrose, is obtained by breaking down corn starch, which is a polymer of glucose molecules (*i.e.*, a chain of glucose molecules bonded to each other). Most industrially important glucose is purified in a crystalline form known as crystalline monohydrate dextrose. There are two other forms of dextrose: alpha anhydrous and beta anhydrous. In this case, CPC contends ADM is infringing its patented process for crystallizing monohydrate dextrose.

A crystal, such as monohydrate dextrose, is a solid whose constituent atoms or molecules are arranged in a periodic, repeating, three-dimensional pattern. Table salt (sodium chloride), for example, is a crystal formed by sodium and chlorine atoms. Just as sodium and chlorine atoms form the building blocks of a salt crystal, individual dextrose molecules form the building blocks for crystalline monohydrate dextrose (unlike table salt, however, crystalline monohydrate dextrose contains only one type of building block—the individual dextrose molecule).

Crystals are derived from solutions which contain the individual molecules that will aggregate to form them; hence, crystallization (for the purposes of this case) is the process by which crystals are assembled from their constituents dissolved in solution. Not surprisingly, to understand the crystallization process one must also understand the properties of solutions.

Solutions are made up of two components: a solvent and a solute. The solute is a solid which, when added to

the solvent, dissolves into the solvent. The solvent is usually water, as it is in this case. Salt Water, for example, is a solution formed when sodium chloride (the solute) is dissolved in water (the solvent).

There are limits as to what amount of a particular solute can be dissolved in a particular solvent—these limits roughly may be described as the "solubility" of a solute in a solvent. A glass of water cannot dissolve an unlimited amount of salt; the solubility of salt in water determines how much salt a given amount of water can absorb. The most important variable affecting solubility is temperature: the higher the temperature, the more solute a particular solvent can absorb. At any given temperature, however, there will be a point at which the solution cannot accommodate the further addition of solute. At this point, a solution is said to be saturated. If further solute is added to a saturated solution, an equal amount of solute must leave the solution by aggregating to form a solid. Crystallization begins as the excess solute precipitates and thereby leaves the solution and solidifies.[1]

To return to the salt water example, if one were to add an amount of table salt to a glass of salt water already saturated with sodium chloride, an equal amount of sodium chloride would precipitate and accumulate at the bottom of the glass. If one were to heat the glass of water, however, some, if not all, of the remaining salt would reenter the salt water solution. If, on the other hand, one were to cool the glass of salt water or evaporate away some of the water to reduce the amount of solvent, additional salt crystals eventually would form and accumulate at the bottom of the glass.

Curiously, however, a lowering of temperature or the evaporation of solvent in a saturated solution will not necessarily result in the immediate precipitation of addi-

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[1] Technically, the emergence from solution is called precipitation; crystallization proceeds with precipitation.

tional solute. Sometimes the additional solute will not precipitate out (and form crystals) unless a triggering event occurs. Solutions existing in such a state are said to be supersaturated, because they hold more solute than they ordinarily can hold. Supersaturated solutions are very unstable (they are "metastable"). The slightest disturbance (agitation, a change in temperature, the introduction of seed crystals) will cause precipitation and hence crystallization to occur; once commenced, precipitation and crystallization will continue until the solution contains the amount of solute such that the solution is merely saturated. Supersaturated, metastable solutions thereby facilitate crystal formation and growth.

When solute molecules such as dextrose emerge from solution, they can incorporate into crystals in either of two ways: nucleation, in which new crystals are formed as solute molecules bind other solute molecules coming out of solution; and, growth, in which already existing crystals grow as solute molecules attach themselves to the molecules that have already come out of solution. The rate of nucleation is often slow; in such cases it is often advantageous to introduce "seed crysals" into the supersaturated solution in order to start the snowball of growth rolling.

Nucleation and crystal growth are competing processes. The competition affects the ultimate size of the crystals: nucleation favors the formation of many smaller crystals; growth favors the formation of fewer, larger crystals.

The interface of the solution and the growing crystal is referred to as the concentration boundary layer. This is where crystal growth occurs. As solute molecules leave the concentration boundary layer and attach to the crystal, the concentration of solute molecules in the boundary layer decreases. As a result, solute molecules from the surrounding solution—which now contains a relatively higher concentration of solute molecules than

the boundary layer—diffuse into the boundary layer in order to restore equilibrium between the boundary layer and the surrounding solution. If the boundary layer is depleted of solute molecules, the crystal cannot grow; hence, the crystal can grow only as fast as solute molecules can diffuse into the boundary layer. As the crystal grows, more solute molecules diffuse into the boundary layer. The tendency of solute molecules to diffuse through the boundary layer is affected primarily by the diffusion coefficient of the solute and the viscosity [2] of the solution. Viscous solutions impede diffusion. Crystallization is said to be diffusion controlled when the rate of crystal growth is controlled by the rate of diffusion. (The science of rates and mechanisms of chemical reaction—in this case a crystallization reaction—is known as kinetics.)

The boundary layer can be reduced, however, by agitating the solution. Agitation allows fresh, relatively concentrated solution to quickly replace solute depleted solution at the boundary layer; it helps to bring solute molecules to the crystal faster than could be accomplished by diffusion alone. When the agitation is sufficient to reduce the boundary layer to its minimum thickness, the rate of crystallization is no longer controlled by the rate of diffusion (the rate at which solute molecules can be brought to the crystal); instead, it is controlled by the rate at which solute molecules can attach themselves to the crystal. Such crystallization, in which solute molecules are brought to the crystal faster than the solute molecules can be assembled on the crystal, is said to be surface reaction controlled. The rate of crystal growth is consequently maximized when crystal growth is surface reaction controlled.

Agitation has other important effects. Increased agitation can cause crystals to break in a process called attri-

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[2] Viscosity roughly corresponds to fluidity. Motor oil, for example, is more viscous than water.

tion. The broken-off pieces of crystal formed by attrition serve as nuclei for new crystals in a process called secondary nucleation. As with primary nucleation, conditions favoring secondary nucleation favor smaller, more numerous crystals. Secondary nucleation can also occur when crystals collide with each other, the agitator, or the walls of the containment vessel. In general, secondary nucleation increases with increased agitation. Agitation thus can facilitate the formation of larger and smaller crystals at the same time.

As large crystals are highly desirable, the patented invention describes a mechanism for maximizing the rate of crystal growth while at the same time minimizing the rate of nucleation. The development of that technology follows.

B. *CPC's Work On The Continuous Crystallization Of Dextrose*

In the 1920's, William Newkirk developed a process for crystallizing batches of alpha hydrate dextrose by mixing a solution containing dissolved dextrose (a feed liquor) in a tank with dextrose hydrate seed crystals to form what is known as a massecuite. He then cooled the massecuite, while slowly agitating the tank over 40 to 120 hours. At the end of the cycle, 20 to 30% of the massecuite was left in the tank for the next batch (to supply seed crystals) and the balance was removed (containing crystals for harvesting).

There are a number of inefficiencies to the batch process approach to crystallizing dextrose. The process takes a long time, requires a substantial capital investment for equipment, presents control or uniformity problems if a manufacturer runs multiple batches at a time, and requires that a substantial percentage of the product be retained as seed for future batches.

In the 1960's CPC began to work on developing a continuous crystallization process in which raw material

would flow into one end of a vessel such that finished crystallized dextrose could be withdrawn from the other end. In 1963, CPC focused its efforts on the continuous crystallization of anhydrous dextrose. It used a forced circulation crystallizer manufactured by Swenson Process Equipment Company.

In the Swenson forced circulation crystallizer, a pump circulated the massecuite from the bottom of the vessel, through a heat exchanger in an external leg, and back through the body of the vessel. Leo Idaszak obtained a patent on that process in June of 1966, and assigned the patent to CPC. A copy of Idaszak's U.S. Patent 3,257,-665 is at defendant's trial exhibit 86 (DTX——). Idaszak's forced circulation crystallizer successfully crystallized anhydrous dextrose.

It was not however as successful in crystallizing monohydrate dextrose. Monohydrate de[x]trose crystallizes at a lower temperature than anhydrous dextrose. It is also more viscous than anhydrous dextrose. The lower temperature needed to ensure crysallation of dextrose in the monohydrate form caused a dramatic increase in the viscosity of the massecuite, and hence made it more difficult to circulate the massecuite through a forced circulation crystallizer.

In 1966 CPC purchased and installed a Swenson forced circulation crystallizer at its plant in Corpus Christi, Texas. In late 1966 and early 1967, CPC tested the Corpus Christi equipment in the crystallization of monohydrate dextrose. The tests demonstrated the feasibility or lack thereof of carrying out continuous crystallization of dextrose monohydrate in a forced circulation crystallizer. CPC discontinued the project after finding that the crystallizers were producing small crystals that increased the massecuite viscosity and thus hindered circulation in the crystallizer.

C. *January 1975 to March, 1977: Edwards Work on the Continuous Crystallization of Dextrose.*

CPC continued to work to develop a more efficient process to crystallize monohydrate dextrose. In January of 1975, Larry W. Edwards, a CPC engineer at CPC's Argo, Illinois, facility began a research project on the kinetics of dextrose monohydrate crystallization. He began work with a mixed-suspension, mixed-product-removal crystallizer, where the feed was continuously supplied to and removed from a well mixed product in a ten gallon vessel equipped with an impeller (or agitator) that had the ability to rotate at three different speeds. Edwards attempted to simulate continuous operation by intermittent addition and discharge of the feed and product.

Edwards continued his research from April through July of 1976, and overhauled the drive system of the ten-gallon crystallizer so that the agitator would run at tip speeds of 64, 101 and 176 centimeters per second. He found that the crystal growth rate changed only slightly over the range of tip speeds from 64 to 176 cm/sec. However, Edwards did find that the nucleation rate increased throughout the range.

Edwards tested his continuous crystallization process in a 300 gallon vessel, with an agitator operating at 60 rpm and a tip speed of 335 cm/sec., but terminated the experiment after having equipment problems.

In April of 1977, Edwards completed a report on his work and summarized the data he had obtained from his work with the ten gallon vessel, including the data on the crystal growth rates and supersaturation at the three tip speeds. He used this data to calculate crystal growth rate constants over the tip speed ranges and noted:

> [A] tip speed of about 60 cm/sec separates the regions of surface reaction and diffusion-controlled crystal growth. Below this tip speed, growth rate

> increased with agitation speed; above this tip speed, little increase was observed.

Plaintiff's trial exhibit 47 (PTX——). Edwards also noted that increasing the tip speed beyond 60 cm/sec. offered no increase in crystal growth, but had the disadvantage of increased nucleation; hence the formation of smaller crystals:

> It seems clear that as growth moves from diffusion to surface reaction control, the basic nucleation mechanism does not change and the rate of nucleation will continue to increase while the growth rate levels off. This combination of effects will cause the average size of crystals to decrease, which can be expected to increase the difficulty of separation.

PTX 47 at page 2250.

He concluded his report with the recommendation that his work be "scaled to commercial size equipment." PTX 47 at 2260.

In May of 1977, Edwards submitted his work for a potential patent application. PTX 49. *See* transcript of the trial at page 269 (hereinafter Tr. ——). He described his invention as one requiring that the "rate of agitation be increased so as to move the system to one in which crystallization rate is controlled by the rate at which the surface reaction occurs." PTX 49, p. 17. He further characterized his invention as including: (a) a high rate of agitation to enhance kinetics; (b) a dilute phase operation to promote good mixing and avoid excessive attrition; and (c) a continuous operation to make seeding of the crystallization unnecessary. PTX 49, p. 18. He noted it was the tip speed of the impeller that enhances the crystallization and wrote:

> It would not be desirable to operate at tip speeds greater than about 60 cm/sec. because of the continuing increase with tip speed of the nucleation rate

> and the resulting adverse effect on crystal size distribution.

PTX 49, p. 20.

In June, Edwards was transferred to CPC's headquarters in Englewood Cliffs, New Jersey. His work on the crystallization of monohydrate dextrose was placed in CPC's "Inactive Ideas" file.

D. *1979: Swenson Scale-Up of the Edwards Work*

In May of 1979, CPC assigned Erwin P. Froehlich, an engineer, the task of examining alternatives for upgrading or rebuilding CPC's plant in North Kansas City, Missouri. He suggested that CPC consider a scale up of Edward's work. Froehlich and another CPC Engineer, Peter K. Carrell, began working with a consultant, Swenson Process Equipment, Company. CPC contacted Swenson because CPC needed assistance in defining the process parameters, including data on the effects of agitator type, size and tip speed on the crystallization rates and crystal sizes. Froehlich and Carrell worked on the project with Swenson engineers Richard Bennett and John Wolf.

In working to implement a scale-up of Edward's work, John Wolf noted that the increase in size of the vessel would require higher tip speeds for the agitator.

> I should also point out that the testwork run in the .30 liter glass jar by CPC on this continuous system only had tip speeds on the agitator of 118 to 347 ft/min. As you know, in commercial equipment we would be talking somewhere between 1100 and 1800 ft/min. depending on the size of the system, etc.

PTX 68, p. 2.

Swenson used a draft tube, evaporation cooled 240 gallon crystallizer. It had a twelve inch diameter, and an eleven inch variable speed agitator. CPC and Swenson tested the crystallizer at tips speeds of 516, 548 and 558 cm/sec.

E. *December, 1980: The Patent Application*

On December 17, 1980, CPC submitted an application for a patent on the Edwards invention. It included in the application a description of Edwards' work in the ten gallon vessel, and a summary of his data at the lower tip speeds. At Froelich's suggestion, CPC also included the following statement:

> Through further testing, it has been found that tip speeds in the range of 300-600 cm/sec offer a reasonable compromise with regard to growth rate, nucleation rate, and cost-efficient mechanical agitator design. Crystal attrition was not found to be detrimental to operation of the system.

In the application, CPC offered the following as a description of the invention:

> Briefly, the present invention provides a process for continuously crystallizing alpha monohydrate dextrose-containing liquor. The process is operated isothermally and produces a lean phase massecuite.

In a preferred embodiment of the invention, the continuous crystallization process is operated as a first stage in a two stage process. The second stage is a batch process that produces a rich phase massecuite. The principles of this invention are illustrated by the description of this preferred embodiment which follows.

In the continuous stage of this process, a dextrose-containing liquor feed is introduced into a first reaction zone comprised substantially of lean phase massecuite having a mean residence time from about 6 to about 30 hours. The reaction zone is continuously agitated at a preselected rate. Such rate of agitation permits linear crystal growth of the feed to occur at a growth rate which is surface reaction controlled. Such rate of agitation also avoids excessive attrition of the lean phase massecuite in the reaction zone. The temperature at which crystallization occurs in the first stage is fixed between about 40° C

and 50° C. The agitation of the reaction zone results in the feed in the continuous stage being rapidly and intimately admixed with the lean phase massecuite. The crystal content of the lean phase massecuite bed provides seed crystals for crystallization of the dextrose liquor feed. The operating conditions of the reaction provide for optimum rate of crystal growth.

In the batch (i.e., second) stage, lean phase massecuite from the continuous stage is introduced into a subsequent reaction zone. The reaction zone is continuously agitated at a rate substantially slower than in the continuous stage to prevent excessive crystal attrition. This rate provides a linear crystal growth rate which is diffusion controlled.

The crystal content of the lean phase massecuite product of the continuous stage provides seed crystals for further crystallization of the lean phase massecuite in the batch stage to produce a rich phase massecuite. The time to complete the crystallization of the lean phase massecuite to the rich phase massecuite product of the batch stage varies from about 6 hours to about 30 hours.

CPC included as an example of a typical and informative illustration of the invention a description of a ten gallon crystallizer, with a liquid depth of 53.1 cm, and a tank diameter of 29.6 cm. The crystallizer has a single shaft turbine with a variable speed drive range of 95 to 570 rpm. On the shaft are two four-inch impeller blades at a 45° pitch.

In a table, CPC described the operation of the process in this crystallizer at tip speeds 64, 101 and 176 cm/sec. at temperatures of 30, 38 and 48 degrees Centigrade.

In a graph, CPC plotted the linear crystal growth rates obtained using this crystallizer at increasing impeller speeds and at two different temperatures. The graph shows a leveling off of the crystal growth rate constant at about 50 to 55 microns/hour at impeller tip speeds of 60 cm/sec. for both temperatures.

CPC did not include an example with data from the Swenson work or illustrating the process at tips speeds higher than the 60 cm/sec. as described by Edwards in his original work.

CPC identified the following claims:

1. A process for continuously crystallizing alpha monohydrate dextrose from a dextrose containing liquor which comprises:

continuously introducing a dextrose-containing feed liquor at a predetermined rate into a first reaction zone comprised substantially of a lean phase massecuite having a crystal phase content between about 15% and about 45% alpha monohydrate dextrose;

continuously agitating said first reaction zone at a rate high enough to promote good mixing of the fed liquor with said lean phase massecuite within said first reaction zone to assure a linear crystal growth rate which is surface reaction controlled but low enough to avoid excessive attribution of said lean phase massecuite within said first reaction zone;

continuously crystallizing said feed liquor within said first reaction zone to form additional lean phase massecuite, said first reaction zone operating at a constant temperature between about 40° C, and about 50° C, the mean residence time of said feed liquor in said first reaction zone being from about 6 hours to about 30 hours; and

continuously withdrawing lean phase massecuite from said first reaction zone.

2. A process as defined in claim 1 further including the step of separating a dry sugar and a mother liquor steam from said lean phase massecuite.

3. A process as defined in claim 1 further including the steps of:

immediately introducing said lean phase massecuite from said first reaction zone into a second reaction zone until said second reaction zone is essentially comprised of said lean phase massecuite; continuously agitating said second reaction zone with cooling coils at a rate at which excessive crystal attrition is avoided while heat is transferred between the coils and the bulk of the massecuite; crystallizing said lean phase massecuite within said second reaction zone at a crystallization temperature from about 35° C for a time period sufficient to form a rich phase massecuite having a crystal phase content above about 60% alphamonohydrate dextrose, the temperature of crystallization being lowered from a preselected initial value to a preselected final value during said time period; and separating alpha-monohydrate dextrose crystals from said rich phase massecuite by removal of mother liquor.

4. A process as defined in claim 1 wherein said rate of agitation is provided by use of an impeller tip speed of about 60 cm/sec.

5. A process as defined in claim 1 wherein said rate of agitation is provided by use of an impeller tip speed between about 300 cm/sec. and about 600 cm/sec.

F. *September, 1981: Notice of Rejection*

In a September, 1981, office action, the Patent and Trademark Office examiner rejected all of the claims in the Edwards' application. He rejected claims 1 and 2

as anticipated by or obvious over the Idaszak patent, stating Idaszak:

> continuously adds dextrose containing feed to a massecuite having a crystal phase of 5 to 65% and simultaneously adding new dextrose sol'n and withdrawing.

PTX 2, p. 31.

The examiner rejected claim 5 as improperly dependent on claim 1, writing:

> Cl. 1 requires avoidance of excessive attrition Spec. at page 9 lines 8-14 imply there will be attrition though not detrimental.

He rejected claims 3 and 4 as obvious, noting as to claim 4 that it was obvious over the Idaszak patent in view of a Lauer patent and noting that the appropriate mixer speed was well within the skill of a worker in the art.

G. *January, 1982: CPC's Amendment to the Application*

CPC responded to the rejection in January of 1982. It amended claim 1 to read as follows (with the amendments underlined):

> 1. (Amended) A process for continuously crystallizing alpha monohydrate dextrose from a dextrose containing liquor *wherein the primary mode of nucleation is secondary* which comprises:
>
> continuously introducing a dextrose-containing feed liquor at a predetermined rate into a first reaction zone comprised substantially of a lean phase massecuite having a crystal phase content between about 15% and about 45% alpha monohydrate dextrose;
>
> continuously agitating said first reaction zone at high enough, to promote good mixing of the feed

liquor with said lean phase massecuite within said first reaction zone *and* to assure a linear crystal growth rate which is surface reaction controlled [but] *and* low enough to avoid excessive attribution of said lean phase massecuite within said first reaction zone;

continuously crystallizing said feed liquor within said first reaction zone to form additional lean phase massecuite, said first reaction zone operating at a constant temperature between about 40° C and about 50° C, the mean residence time of said feed liquor in said first reaction zone being from about 6 hours to about 30 hours; and

continuously withdrawing lean phase massecuite from said first reaction zone.

CPC responded to the examiner's rejection of claims 4 and 5 by noting that these amendments made clear that there can be non-detrimental attrition of the crystals, and that the rate of agitation identified in the claims is low enough to avoid excessive or detrimental attrition.

In response to the examiner's rejection of Claims 1 and 2 as anticipated by or obvious over Idaszak's patent, CPC argued that Idaszak relates to evaporation-crystallization, and that Idaszak does not suggest agitation speeds, an agitation rate for surface reaction controlled crystallization, or that surface reaction controlled crystallization can be obtained without excessive attrition.

In response to the examiner's rejection of Claim 4 based on his finding that the mixer speed is well within the skill of the art as demonstrated by Lauer's U.S. Patent No. 3,607,392, CPC argued that Lauer does not mention surface controlled crystallization, and that while Lauer disclosed the revolutions per minute of an agitator, he did not provide enough information to calculate tip speeds: "There is no hint of using an agitation speed of about

60cm sec. tip speed. Moreover, there is no hint that the crystallization mechanism be shifted from diffusion controlled to surface reaction controlled at about 60 cm/sec. tip speed as in the instant invention." PTX 2 at page 44.

CPC also argued that even if Lauer and Newkirk were combined, the combination of the teachings fell short of the claimed invention, as they do not show or suggest the agitation rate for optimum crystal growth for alpha monohydrate dextrose without excessive attrition or agitation at a rate to assure linear crystal growth which is surface reaction controlled or an agitation rate high enough to be surface reaction controlled and low enough to be non-detrimental to the crystals in a lean phase massecuite having a crystal phase content between about 15% and 45% alpha monohydrate dextrose. See PTX 2 at page 45.

In setting out this argument, CPC enclosed copies of two U.S. Patents, both of which relate to a process for crysallizing dextrose. In U.S. patent 3,440,093, Idaszak identified a forced circulation crystallizer. In U.S. patent 3,547,696, Dr. Helmut Mueller identified a batch process. CPC argued that neither of these patents suggested surface reaction controlled linear crystal growth or agitation tip speeds high enough to provide surface reaction controlled linear crystal growth and low enough to avoid excessive attrition of the crystals. PTX 2 at page 47.

H. *March, 1982: The Examiner's Amendment to Claim 1.*

During a March 9, 1982, telephone interview with the examiner, CPC's patent counsel agreed that the range of tip speeds should be incorporated into claim 1 in order to distinguish more clearly the agitating step from that of the prior art. Claim 1 was changed by an examiner's amendment to read in part as follows (with the change underlined):

> [C]ontinuously agitating said first reaction zone at *an impeller tip speed rate of from about 60 cm/sec to about 600 cm/sec. said rate being characterized* high enough to promote good mixing of the feed liquor with said lean phase massecuite within said first reaction zone and to assure a linear crystal growth rate which is surface reaction controlled and low enough to avoid excessive attrition of said lean phase massecuite within said first reaction zone. . . .

I. *November, 1982: The Patent is Issued*

On November 2, 1982, the Patent Office issued to CPC as the assignee of the inventor Larry W. Edwards, U.S. Patent No. 4,357,172, titled "Process for Continuous Crystallization of Alpha Monohydrate Dextrose Utilizing High Agitation." PTX 1.

II. *The Defendant's Process*

CPC claims ADM infringes claims 1 and 5 of the Edwards patent in making monohydrate dextrose at its plant in Clinton, Iowa.

ADM has been making monohydrate dextrose at that plant since it leased it in 1982. Previously, the plant was operated by Clinton Corn. In the original process at the plant, dextrose feed liquor was supplied from coolers to Kilby batch crystallizers. The Kilbys contained single speed, slow-moving impellers. In 1968, Clinton Corn tested and began installing variable speed impellers in the Kilbys. In 1978, Clinton linked the coolers and Kilbys and mixed massecuite and dextrose containing feed liquor was introduced to the coolers and emptied into the Kilbys.

ADM has modified the process at the plant by adding crystallizers and stage tanks. The most recent modification was the addition of four evaporative crystallizers which produce seed crystals for the batch phase of the crystallization process. The idea for using the evaporative crystallizer came from Richard Bennett at Swenson, who

had worked with CPC on the draft-tube crystallizers. While eventually it built the crystallizers at Clinton from used equipment, CPC refers to these crystallizers as Swensons, and identifies them as S-1, S-2, S-5 and S-6.

PTX 212 shows a schematic drawing of the ADM process. Each of these units has a fixed agitator rate with a specific RPM or tip speed. In these draft tube crystallizers the liquid is pumped by the agitator from the bottom of the vessel up through the tube and flows out of the top.

Units S-1 and S-2 have a capacity of 17,000 gallons and operate at tip speeds of 944 cm/sec. and 740 cm/sec. Unit S-5 has a capacity of 22,200 gallons and operates at a tip speed of 986 cm/sec. Unit S-6 has a capacity of 22,500 gallons and operates at a tip speed of 616 cm/sec. The temperature in the four crystallizers varies from 107 to 120 degrees Fahrenheit.

DISCUSSION

The parties tried the infringement, invalidity and unenforceability issues to the Court over the course of seven days in February of this year. During the trial, in the post-trial briefing, and at oral argument, ADM identified a number of different theories as to why the Court should deny CPC's claim for relief. Indeed, on reading ADM's post-trial answering brief, the Court had the sense that with the turn of each page of the 167 pages of the brief, ADM would greet the Court with a new theory, one more reason why the Court should find ADM had not infringed the patent, one more reason why the Court should find CPC's patent invalid, or one more reason why the Court should deny CPC's request for relief. These arguments can be distilled to three essential issues:

1) *The Effect of CPC's Adding Impeller Tip Speeds To Claim 1.* Having amended claim 1 during the prosecution of the patent to insert the limitation that the impeller have a tip speed from about 60 to about 600 cm/sec., should CPC be estopped from arguing that ADM's units

with tip speeds in excess of 700 cm/sec. perform substantially the same function in substantially the same way to achieve substantially the same result?

2) *Prior Art.* Should the Court find the '172 patent invalid or unenforceable in light of certain prior art that ADM contends anticipates or renders the claims obvious, the principal items being a 1958 article by Sadovyi and Chabik and a 1951 article by McCabe and Stevens, neither of which CPC disclosed to the patent office?

3) *The Adequacy of CPC's Description Of The Invention And Its Disclosure of Swenson's Work.* Should the Court find the '172 patent invalid or unenforceable either because of inadequacies in CPC's attempt to define the nature of Edwards' invention in terms of impeller tip speeds, or because of its failure to describe Swenson's scale-up of the process?

The first issue relates to infringement; the latter issues relate to the validity of the patent. In what follows, the Court addresses these issues and others, including those relating to the enforceability of the patent.

I. *Infringement*

CPC contends ADM's four Swenson crystallizers at the Clinton plant infringe claims 1 and 5 of the '172 patent either literally or under the doctrine of equivalents.

A. *Literal Infringement*

ADM offered several responses to CPC's claim of literal infringement. The Court first discusses whether a tip speed of 616 cm/sec. literally infringes, and then discusses the remaining arguments.

1. *Does the S-6 Tip Speed Of 616 cm/sec. Fall Within The Claim Limits?*

In its complaint, CPC simply alleged ADM was infringing its '172 patent. In discovery, ADM described the

process it used to crystallize dextrose at the Clinton plant and reported its contention that its process does not infringe claims 1 and 5 of the patent as "the tip speeds of all of these crystallizers in Stage A exceed 600 cm/sec., so claim 1 is not infringed. . . . Since claims 2-5 are dependent on claim 1, and since there is no infringement of claim 1, there can be no infringement of these dependent claims." Defendant's April 14, 1992 Further Supplemental Response to Plaintiff's Interrogatory No. 8, PTX 122.

CPC argues that with a tip speed of 616 cm/sec. S-6 Swenson unit literally infringes claims 1 and 5 of the '172 patent, as the tip speed of 616 cm/sec. is sufficiently close to 600 cm/sec. to be "about 600 cm/sec." and thus falls within claim 1's identification of tip speeds "from about 60 cm/sec. to about 600 cm/sec." and within claim 5's identification "of an impeller tip speed between about 300 cm/sec. and about 600 cm/sec." ADM argues that 616 is not "about 600," and notes that CPC can offer no principled explanation for where this high end number for the tip speed came from, except that it may be a product of rounding the high end tip speed of 558 from the Swenson tests. ADM suggests that "about 600" should be read to be no more than 600 to 603, a variation upward of one half of one percent of the high end speed.

It appears that in setting up an upper limit of "about 600 cm/sec." CPC: (1) picked a number rounded up from the tip speed calculated with Swenson, which was 558; (2) selected 600 as the next hundred in a range from 300 to 600 cm/sec.; and, (3) added "about" intending to suggest that the number need not be exactly 600 or less, but could be in the range of 600. Accordingly, the Court finds 616 cm/sec. falls within this range from about 300 to about 600 as claimed by CPC.

2. *ADM's Other Defenses To CPC's Claims Of Literal Infringement.*

At the trial, ADM offered evidence in support of a number of other theories as to why it contends its crystallizers do not infringe the patent, including testimony by its expert questioning whether ADM's process created excessive attrition and whether the crystallizers were functioning in a surface reaction controlled zone. That witness also suggested the '172 patent did not cover ADM's evaporative cooling crystallization. CPC objected to ADM's reliance on these theories of non-infringement contending ADM had not fairly disclosed them in discovery.

CPC filed this case in August, 1991. In a first set of nine interrogatories served in October, 1991, CPC sought basic information from ADM concerning its contentions with regard to CPC's claims and the '172 patent, including an identification of any contention by the defendant that the '172 was invalid or unenforceable. By interrogatory number eight, CPC asked ADM to state whether it contends that its process does not infringe the claims of the patent in suit and to set forth as to each claim each claimed process step which defendant contends is not found in the ADM process. PTX 256.

In December, 1991, ADM responded to these interrogatories by objecting and refusing to identify its contentions. Following a discovery conference, on March 16, 1992, ADM filed supplemental responses to the interrogatories and reported it would provide a written explanation for its contentions. PTX 258.

The case was reassigned to this judge on March 30, 1992. On April 14, 1992, ADM served a further supplemental response to the interrogatories. In response to interrogatories five, six, and seven, ADM set out the bases for its contentions that the '172 patent was invalid as being anticipated by prior art, obvious, and indefinite. In answer to interrogatory number eight, ADM referred to a

drawing that identified the six stages of its crystallization system at the Clinton Plant as A through F, with the crystallizers identified as Stage A, and reported it contended its process did not infringe the patent for the following reasons: (1) the tip speeds of the crystallizers in Stage A exceed 600 cm/sec.; (2) the residence time of the feed liquor in cooler/crystallizer in Stage B is about six to thirty hours; (3) no dextrose-containing feed liquor is introduced into the crystallizers at stage tanks, Stage C; (4) no dextrose-containing feed liquor is introduced into the second cooler/crystallizer at Stage D; (5) the tip speeds at the Werkspor crystallizer at Stage 6 are below 60 cm/sec.; and (6) two additional contentions as to why ADM does not infringe Claim 3 of the patent. *See* PTX 122. By these answers, ADM had identified only a single ground for contending the crystallizers at Stage A were not infringing the '172 patent: their tip speeds exceeded 600 cm/sec.

On April 15, 1992, following a scheduling conference, the Court entered an order setting the case for trial beginning on February 1, 1993. CPC deposed ADM's technical expert on November 18 and 19, 1992 and again on January 6, 1993.

On January 20, 1993, ADM served a supplemental interrogtaory response, noting:

> As part of this burden, CPC must prove that the accused process, not only uses an impeller tip speed rate from 60 cm/sec to 600 cm/sec, but also that the agitation rate is high enough to promote 'good mixing' and to assure 'a linear crystal growth rate which is surface reaction controlled', and low enough 'to avoid excessive attrition' as required by claim 1.

DTX 279, p. 9

ADM incorporated that statement in its portion of the draft pretrial order filed on January 19, 1993.

ADM never supplemented its response to interrogatory number eight to disclose that it intended to contend that its process did not infringe the '172 patent as it did not create excessive attrition, did not operate at surface reaction control, and utilizes draft tube evaporation. Nor did ADM include these matters in the proposed pretrial order under the statement of issues of fact remaining to be litigated.

The Court finds ADM waived the right to assert these matters as defenses to CPC's claims of infringement, both by failing to identify them in response to CPC's interrogatory and by failing to include them in the draft pretrial order.

For these reasons the Court also finds ADM waived the right to rely on the defense it has identified in its post-trial briefing, that CPC has failed to prove its process infringes as it has failed to prove ADM's accused process operates at agitation rates sufficient to promote "good mixing."

B. *Infring[e]ment Under The Doctrine Of Equivalents*

The other three Swenson units at ADM's Clinton plant operate at tip speeds of 740, 944 and 986 cm/sec. CPC does not contend that those speeds are "about" 600 cm/sec. or that ADM's use of the units literally infringes the '172 patent. CPC contends ADM's use of these units infringes the '172 patent under the doctrine of equivalents.

CPC argues that the agitation step employed by ADM meets the standard for equivalency set out by the Supreme Court in *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 70 S. Ct. 854, 94 L.Ed. 1097 (1950). That is, the agitation step at the higher speeds performs substantially the same function in substantially the same way to achieve substantially the same result as does the agitation step in the '172 patent.

CPC notes that ADM uses high tip speeds only because its crystallization vessels are larger than those contemplated by the Edwards patent. It argues that one skilled in the art would have known that higher tip speeds are called for with increasing vessel sizes and that under *Graver* one of the factors to be taken into account in determining equivalence is whether one skilled in the art would have known or appreciated the equivalency. ("An important factor is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was." *Graver*, 339 U.S. at 609, 70 S.Ct. at 856).

ADM counters that CPC faced this issue of setting a range for tip speeds when it was applying for the patent and that it defined the scope of its claim at that time by fixing the range of speeds at "about 60 cm/sec. to about 600 cm/sec." and "between about 300 cm/sec. and about 600 cm/sec." ADM consequently argues that CPC disavowed a claim to tip speeds over 600 cm/sec. and urges the Court to find that CPC is estopped from claiming agitators at a higher tip speed infringe, as CPC should not be allowed to recapture within the scope of its claims that which it expressly disavowed during the prosecution of the '172 patent. *See Autogiro Co. of Am. v. United States*, 384 F.2d 391, 400-01 (1967) ("The doctrine of equivalence is subservient to file wrapper estoppel. It may not include within its range anything that would vitiate limitations expressed before the Patent Office. Thus a patent that has been severely limited to avoid the prior art will only have a small range between it and the point beyond which it violates file wrapper estoppel").

In its patent application, CPC had reported that the object of the patent was to provide an improved process for continuously crystallizing alpha monohydrate dextrose. The process could be carried out in a minimum amount of time thereby improving productivity by eliminating the need for leaving a seed bed as is required in batch crystal-

lizers. See PTX 2. In describing the invention, CPC reported:

> The reaction zone is continuously agitated at a preselected rate. Such rate of agitation permits linear crystal growth of the feed to occur at a growth rate which is surface reaction controlled. Such rate of agitation also avoids excessive attrition of the lean phase massecuite in the reaction zone.

PTX 2 at 11. This description of the invention suggests CPC had concluded that the essence of Edward's invention was the finding that there exists an optimal level of agitation where crystal growth is surface reaction controlled, yet attrition is minimized. The optimal level of agitation would involve the slowest tip speed rate at which crystallization would achieve surface reaction control, *i.e.*, the tip speed rate at which the crystallization changes to surface reaction control from diffusion control.

CPC had described the invention as a finding that there was an optimal level of agitation. It offered Edward's work as an example to illustrate the invention in a particular vessel. CPC described the volume of the crystallizer, its depth, the size and pitch of the blade, and the rotation of the blade. CPC reported that its experiments showed that the optimal tip speed of the agitator for that vessel was 60 cm/sec.

It is obvious from reading the application (and would have been obvious to one skilled in the art) that this optimal tip speed would vary according to changes in the shape and size of the vessel and in the shape and size of the agitator blade. A fair reading of the application would lead one to conclude that CPC intended to report that Edwards had found there was an optimal level of agitation, had determined for the ten gallon vessel that the level could be described in terms of the tip speed of the agitator, and had found that for the ten gallon vessel the optimal tip speed was 60 cm/sec. A fair reading of

the application would also lead one to conclude that CPC had done further testing of this finding and concluded that the optimal rate in other vessels could be obtained with tip speeds ranging from 300 to 600 cm/sec. (and not that CPC had obtained the same result of crystal growth in surface reaction control, with minimal excessive attrition in the same vessel, and with the same agitator travelling at tip speeds of 300 to 600 cm/sec.). CPC included in Claim 1 of its application its general description of Edwards' invention, and in claim 4 claimed the process at Edward's 60 cm/sec. tip speed and in claim 5 claimed the process at the Swenson 300 to 600 cm/sec. tip speeds.

The patent examiner initially rejected CPC's claims to this invention, finding in part that CPC's claim to a process for continuous crystallization was obvious over Idaszak, and that its claim to a particular mixer speed was obvious in light of Lauer. In response, CPC argued to the examiner that Idaszak did not suggest an agitation rate, but suggested only that the massecuite should be kept in motion. CPC further argued that Lauer did not suggest surface reaction controlled crystallization, or discuss an agitator tip speed.

It was in responding to these rejections that CPC sought to clarify claim 1 and its description of the Edwards invention. It did not, however, clarify the claim by attempting to describe or define the optimal level of agitation that achieves surface reaction control without excessive attrition. Instead, in what appears to have been a conceptual error, CPC sought to define its claim by the examples of tip speeds it knew worked and that it had already set out in claims 4 and 5.

CPC might have been able to describe or define in its claims how to obtain that universal optimum rate of agitation. It did not. It should have been obvious to CPC that the examples it incorporated did not describe a universal optimum rate of agitation. By incorporating the

examples into the description of the claim, CPC limited its claim to Edward's process as implemented in certain vessels where the optimal rate of agitation could be achieved at tip speeds of "about 60 cm/sec. to about 600 cm/sec."

CPC argues that it had changed its claim to distinguish Idaszak. Idaszak had provided for keeping the massecuite in motion, but had not suggested agitation at a rate to provide surface reaction controlled linear growth. CPC added tip speeds to suggest that the level of agitation was sufficient to assure a high rate of linear crystal growth, and that the tip speeds at the lower end of its range had accomplished this.

Citing *Read Corp. v. Portec, Inc.*, 970 F.2d 816, 824 (Fed.Cir. 1992), CPC contends the Court should look to the purpose of the change, find it would not have been necessary for CPC to add the upper range of the tip speed of 600 cm/sec. to distinguish Idaszak, and determine that CPC should not, therefore, be estopped from claiming processes with tip speeds over 600 cm/sec. should be held to infringe under the doctrine of equivalents.

Even if it is true that the addition of the upper limit of 600 cm/sec. was unnecessary to distinguish Idaszak and that it would have been obvious to surpass the 600 cm/sec. limit in adapting the patented invention to larger vessels, CPC must be held to the language of its claims. CPC may have claimed less than it may have been entitled to claim, but the fact remains that CPC had put the public on notice of an upper limit and the public could fairly expect that limit to have meaning. The doctrine of equivalents does not provide a mechanism by which patentees can later recapture what they might have once properly obtained, rather it ensures that the limitations of literal language do not result in the exclusion from the scope of the claims those inventions that one reasonably skilled in the art would have understood to be included. CPC asks the Court to apply the doctrine in the former sense; in effect, it asks the Court to employ the doctrine

of equivalents to eliminate—rather than ameliorate—otherwise clear claim language. Applying the doctrine in the latter, proper sense, the Court finds that the claim language should not extend to cover units with tip speeds significantly higher than 600 cm/sec. and consequently does not cover Swenson units operating at tip speeds of 740 cm/sec. or higher.

II. *Invalidity*

ADM contends the '172 patent is invalid as anticipated, obvious with respect to the totality of prior art, and incomplete as it does not disclose the best mode for practicing the invention, does not enable the invention in its claims, contains indefinite terms, and fails to name all of the true inventors. The Court addresses each of these six issues in turn.

A. *Novelty*

ADM contends the '172 patent is invalid under 35 U.S.C. §§ 102(a) and (b), as all of the elements of the process recited in claims 1 and 5 were disclosed in a 1958 article by I.E. Sadovyi and I.A. Chubik of the Leningrad Technological Institute of the Food Industry, titled "The Influence of Agitation On The Speed Of Crystallization Of Glucose" and published in the Reports Of Higher Training Institutes Of The Ministry Of Higher Education of The USSR. DTX 159.

The '172 patent is presumed valid. 35 U.S.C. § 282. To establish that it is invalid for lack of novelty, ADM must prove by clear and convincing evidence that all of the elements of the patent's process are present in the Sadovyi and Chubik article. *American Hoist & Derrick Co. v. Sowa & Sons, Inc.*, 725 F.2d 1350 (Fed.Cir. 1984). For the reasons set forth below, the Court concludes the Sadovyi and Chubik article does not contain each of the elements of the process claimed in the '172 patent, and that ADM has, therefore, failed to meet its

burden of proof to show the patent should be found invalid for lack of novelty.

In their article, Sadovyi and Chubik report on experiments measuring the rate of diffusion or growth of dextrose crystals when different types of mixers are used in a crystallizer. They used wide-neck beakers with a diameter of 100 mm as a crystallizer, with different mixers, a vane, a propeller, and a turbine, each with a diameter of 55 mm. They conducted the experiments at one, five, ten, and twenty revolutions per minute. By comparing crystallization with this intensive agitation to crystallization without agitation, they developed what they called the coefficient of efficiency of crystallization with intensive agitation.

Sadovyi and Chubik also review the relative efficiency of the different types of mixers and report on their review of microphotographs of the crystals to study the "wearing-down of the crystals in use of intense inter-mixing of massecuite." They concluded that an increase in the relative velocity of the crystals increases the rate of crystallization which can be explained by the reduction in the thickness of the low-motility layer surrounding the crystal and by an increase in the glucose diffusion rate.

CPC contends that the Sadovyi and Chubik article fails to anticipate the Edwards invention in that it does not describe a surface reaction controlled mechanism as required by claim 1. ADM contends that while the Sadovyi and Chubik article does not use the words "surface reaction controlled mechanism," it does recognize the need and the desire to move into surface reaction control, and in support of that argument ADM points to passages at pages 2, 3, 8, 9 and 10 of the article where it contends the authors discuss moving into surface reaction control. Examples of the passages relied on by ADM include the following:

> With the distance from the face of the crystal, the concentration of the solution rises, reaching a deter-

> mined excess concentration. . . . It takes place, a diffusion of glucose from the super-saturated solution to the facets of the crystal. . . . The crystallization of the glucose massecuite ordinarily takes place with slow displacement. . . . With increase of the number of revolutions of the mixer, there rises the relative speed of the crystals in the intercrystalline solution, bringing about therein a reduction of the thickness of the low motility layer surrounding the crystals and accelerating the glucose crystallization. . . . Increase of the relative velocity of the crystals in the intercrystalline solution raises the rate of glucose crystallization. This is explained by the reduction of thickness of the low motility layers surrounding the crystal, and by increase of the glucose diffusion rate from the solution to the facets of the crystal.

Sadovyi and Chubik at pages 2, 3, 8, 9, and 10, reported at the Trial Transcript, pages 934 to 936.

On reading these and the other passages relied on by ADM, the Court cannot find Sadovyi and Chubik described a surface reaction controlled mechanism. There is no evidence that Sadovyi and Chubik accomplished anything more than to reduce the thickness of the boundary, i.e., there is no evidence that they *minimized* the thickness of the boundary layer, which would indicate surface reaction control, or know if they had done so.

CPC also contends that Sadovyi and Chubik does not describe a continuous process, in the sense that it does not describe a continuous supply of feed and continuous withdrawal of product, so that the process is operating at a steady state.

Sadovyi and Chubik refers to a steady-state crystallization, yet describes only a semi-continuous process where a third of the product is removed and then material is added back. ADM suggests that Sadovyi and Chubik had anticipated a steady state continuous process, but had not implemented it because of equipment limitations.

Edwards had worked with a similar limitation, as he had attempted to simulate a continuous operation with a ten gallon crystallizer. Additionally, CPC had included in the patent's specifications a statement that addition of feed liquor and removal of lean phase massecuite "may be rapid and comprise up to about ⅓ of the total volume of lean phase massecuite." DTX 2 at col. 6, lines 29 and 30. While there are similarities between Sadovyi and Chubik's and CPC's description of their processes, CPC additionally attempted to describe and claim a continuous process, with a continuous supply of feed and continuous withdrawal of product. Thus, for example, at column 7, line 15 of the specifications, CPC wrote, "A distinct advantage of applicant's crystallization process is that operation of the continuous state of the process may be carried out at constant conditions once equilibrium is established." Sadovyi and Chubik does not describe this continuous process.

B. *Obviousness*

ADM contends the Court should find the '172 patent invalid under 35 U.S.C. § 103 as the subject matter of the patent as a whole would have been obvious to a person having ordinary skill in the art at the time the alleged invention was made. ADM constructs this argument around three principal works of prior art, Sadovyi and Chubik, Idaszak, and a 1951 article by McCabe and Stevens titled "Rate of Growth of Crystals in Aqueous Solutions," *Chemical Engineering Progress*, page 168, (April 1951). DTX 116. ADM contends that when considered in combination these three works teach a non-seed continuous process for surface reaction controlled crystallization.

In their 1951 article, McCabe and Stevens report on their analysis of copper sulfate pentahydrate crystal growth in an agitated solution and their efforts to determine how the rate of crystal growth is affected by the

relative velocity between the crystal and the solution in which it is growing. They note that as the relative velocity between the solution and the crystals increases, the growth rate increases rapidly from a finite value and approaches asymptotically a rate independent of velocity. In their conclusions, they report that the growth process consists of a mass transfer of solute to the solution/crystal interface followed by an interfacial reaction, and that in industrial crystallizers the growth rate will be a function of crystal size and the growth of larger crystals will be favored.

In *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 86 S.Ct. 684, 693-94, 15 L.Ed.2d 545 (1966), the Supreme Court interpreted the nonobviousness requirement in 35 U.S.C. § 103 as follows:

> Under 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc. might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

In this case, the parties agree that Sadovyi and Chubik, Idaszak and McCabe and Stevens all are prior art. They also generally agree that the level of ordinary skill in the pertinent art would be that of a person such as Edwards, who has a Bachelor of Science degree in chemical engineering and about two years of experience in the crystallization field. They disagree, however, as to determining the differences between the prior art and the claims at issue, and on the extent to which secondary considerations give light to the circumstances surrounding the origin of the subject matter of the patent.

CPC concedes that Idaszak and others teach a continuous crystallization process and that McCabe taught surface reaction control. It argues, however, that ADM has failed to prove by clear and convincing evidence that the combination of these references would have been obvious: "If a surface reaction controlled mechanism was so obvious in the 1950's, why did the prior art fail to apply that mechanism to dextrose crystallization until Edwards did in the mid-1970's?" CPC's Post-Trial Reply Brief at page 107.

There exists only scant information in the record to suggest the McCabe and Stevens article would have rendered obvious Edward's invention of a process for surface reaction controlled crystallization of dextrose. One item of evidence ADM highlights is a copy of a memorandum from CPC's files prepared by F.W. Schenck, dated July 28, 1964, and titled "Crystallization of Dextrose." DTX 117. In that memorandum Schenck cites the McCabe and Stevens article as a reference in a footnote. It is not clear how this information should be interpreted. In the memorandum, Schenck spoke to the topic of applying engineering principles to the art of crystallization and discussed two basic crystallization study strategies that had been used in the past: observance of single crystals and observance of many crystals. In discussing experiments observing many crystals, Schenck cited 1929, 1934 and 1951 articles by McCabe as references for the statement, "Many different experimental procedures have been used to determine the growth rate of groups of crystals, all with apparent success." Schenck neither cited McCabe and Stevens for the proposition that it disclosed a surface reaction controlled process, nor indicated that he read the article as suggesting monohydrate dextrose could be crystallized with a surface reaction controlled process.

Schenck's reference to the McCabe and Stevens article shows CPC was aware of the work and understood that the work was relevant to the crystallization of dextrose.

Schenck's failure to identify the McCabe and Stevens discussion of surface reaction control suggests that the connection between that disclosure and CPC's work in crystallizing dextrose was not obvious to him, and by extension perhaps not obvious to one skilled in the art.

With this information from Schenck's memorandum, and the lack of evidence suggesting that for the period from 1951 to 1975 others in the industry connected McCabe's finding on surface reaction controlled crystallization of copper sulfate pentahydrate crystals to a possible method for improving the process for the crystallization of dextrose, the Court finds ADM has failed to meet its burden of proof to overcome the presumption of validity of the '172 patent and show by clear and convincing evidence that the invention would have been obvious at the time it was made.

C. *Best Mode*

A patent is valid only if it sets forth the "best mode" contemplated by the inventor for carrying out the invention. 35 U.S.C. § 112. ADM contends that because CPC failed to set forth the Swenson development work involving the scale-up of the Edwards invention, CPC knowingly failed to disclose the best mode of practicing the invention.

In *Amgen, Inc. v. Chugai Pharmaceutical Co., Ltd.*, 927 F.2d 1200, 1209-10 (1991), the Federal Circuit discussed the purpose of the best mode requirement:

> The best mode requirement . . . is intended to ensure that a patent applicant plays fair and square with the patent system. It is a requirement that the quid pro quo of the patent grant be satisfied. One must not receive the right to exclude others unless at the time of filing he has provided an adequate disclosure of the best mode known to him of carrying out his invention.

Accordingly, in order to determine whether a patent is invalid under 35 U.S.C. § 112, ¶ 1, the trier of fact must consider: 1) whether the inventor knew of a mode of practicing the invention that he considered to be superior to any other mode; and, 2) whether the inventor concealed the superior mode from the public. *Chemcast Corp. v. Arco Indus. Corp.*, 913 F.2d 923, 927-27 (Fed.Cir. 1990). Concealment may be accidental or intentional. *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1535 (Fed.Cir.1987).

1. *The applicants' relevant knowledge*

Edwards completed his work on the continuous crystallization of dextrose by June, 1977, when he was transferred to another job at CPC and his work was placed in an inactive ideas file. CPC reactivated the work in 1979 and 1980, when it undertook the scale-up with Swenson.

CPC prepared and filed the patent application in December, 1980. There is no evidence to suggest that Edwards played a significant role in the preparation of the application or the drafting of the specifications, or that he was even aware of the Swenson work.

Because CPC was primarily involved in the preparation and filing of the patent application, the purpose of the statute would not be served merely by looking to Edwards' intent at the time the application was filed. The Court must instead consider the information available to both Edwards and his agent, CPC, at the time they applied for the patent. *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1535 (Fed.Cir.1987).

2. *Concealment of the best mode for practicing the claimed invention*

In the patent specification, CPC described Edwards' invention without regard to shape or size of the vessel, the shape or size of the agitator, or the method of agita-

tion. It reported it had found through experimental tests using turbine blades to produce agitation that "an impeller tip speed of about 60 cm/sec separates the regions of surface reaction and diffusion-controlled crystal growth." CPC further noted that through further testing "it has been found that tip speeds in the range of 300-600 cm/sec offer a reasonable compromise with regard to growth rate, nucleation rate, and cost-efficient mechanical agitation design."

The patent does not refer to Swenson's scale-up work, which showed that Edwards' tip speeds—to which Edwards had ascribed an upper limit of 60 cm/sec.—were inoperative at the pilot-plant scale and that pilot plant tests were actually conducted at tip speeds ranging from 516 to 558 cm/sec. The identification and description of Edwards' work is thus the only mode for practicing the invention disclosed in the patent. ADM argues that Swenson's work is the best mode, as Edwards had recognized the need to scale up, as Swenson rejected Edwards' suggestion that tip speeds be limited to 60 cm/sec., and as CPC incorporated Swenson's tip speeds into claims 1 and 5 of the patent. More precisely, ADM contends that the process conditions developed during the Swenson pilot-plant studies were the best mode known to CPC at the time it filed the '172 patent application, and that CPC withheld this process information.

The court concludes that the Swenson work was the best mode known to CPC for practicing the claimed invention and that the Swenson work was concealed from the public. CPC had taken Edwards' work to Swenson and invested time and money in a scale up in order to determine the efficacy of the process. That scale-up apparently demonstrated that the process would work on a commercial scale and it provided information to CPC on a method for implementing the process. CPC used that information to stretch its claims to cover that work,

including expanding Edwards' claim for a tip speed from 60 cm/sec. to 600 cm/sec.

As noted above, it would have been apparent to CPC and others at the time that scaling up Edwards' work would have required an adjustment in Edwards' proposed optimum tip speed. By including a description of Edwards' work and failing to describe the Swenson scale up, CPC intentionally failed to disclose what it knew at the time was the best mode for implementing what it intended the invention to be, a commercial process.

CPC has argued that even if the Court finds it intentionally failed to disclose the Swenson work, the Court should, nevertheless, decline to find the patent invalid, as the information relating to the scale-up was nothing more than the product of a routine application of skill in the art to allow the practice of the invention. *See e.g. H.H. Robertson Co. v. Barger Metal Fabricating Co.*, 225 USPQ 1191, 1204, 1984 WL 1849 (N.D.Ohio 1984). The Court finds facts to the contrary.

In 1979, Edward's work was on the shelf. CPC approached Swenson for assistance in developing a crystallizer and provided copies of Edward's paper to the team working on the project. That team did the work necessary to scale-up Edward's invention to commercial sized equipment and in the process realized Edward's conceptual error in concluding that 60 cm/sec. was a maximum appropriate tip speed. The team scaled up the work by determining appropriate shapes and sizes for the vessel and impeller, and appropriate tip speeds for the impeller.

Consequently, even if a person of reasonable skill in the art would have known to scale-up the Edwards work, significant experimentation would have been required to practice the process at a commercial scale. CPC knew from their experience with Edwards' data, furthermore, that disclosure of the Swenson work would have significantly abated the need to conduct much of that experimentation.

The timing of CPC's patent application also suggests it was CPC's work with Swenson that demonstrated the value of Edward's invention. In preparing the application, CPC stretched and redefined Edward's definition of his invention to cover what CPC learned in the scale-up. And when the examiner initially rejected the application as obvious in light of Idaszak, CPC looked to the scale-up tip speeds to demonstrate that the invention was not obvious. In sum, the Swenson work was simply too important to ignore, belying CPC's claim that those skilled in the art would have readily recognized how to scale-up the Edwards work.

Finally, the Court finds that the Swenson work was in fact concealed. The patent's only reference to the Swenson work reads as follows:

> Through further testing . . . it has been found that tip speeds in the range of 300-600 cm/sec offer a reasonable compromise with regard to growth rate, nucleation rate, and cost-efficient mechanical design.

The reference does not specifically mention the Swenson work, disclose the Swenson data, or offer assistance as to where such information may be found. The details of the "further testing" are left to speculation. In short, the reference to the Swenson work is not only obscure, but also too general to apprise a reader of the patent of any of the useful details—those necessary to practice the best mode of the invention—embodied in the Swenson work.

D. *Enablement*

ADM contends the Court should find the '172 patent invalid under 35 U.S.C. § 101, because it is not possible to practice the process as claimed based on the information disclosed it the patent.

As the patent does sets forth sufficient information in the specifications and the description of Edwards' work for one skilled in the art to practice the invention without

undue experimentation, the Court will reject this argument.

As noted in the previous section, however, the patent is not enabled with respect to the preferred embodiment of the invention. It is enabled only in a general sense. *See Spectra-Physics, supra.*

E. *Indefiniteness*

ADM contends the terms "good mixing," "excessive attrition" and "about," which define the claimed process, do not utilize the degree of particularity required by Section 112.

As these words of degree are sufficiently clear and understandable to one skilled in the art, the Court will reject this argument. A skilled chemical engineer would understand what the author of the patent intended in describing a rate of agitation high enough to promote good mixing of the feed liquor with the lean phase massecuite. That engineer would also understand what the author intended in referring to a rate of agitation sufficiently low so as to avoid excessive attrition. Thus, the terms of art, understood in context, are sufficiently clear to apprise the public of the basic concepts embodied in the invention. Finally, in the context of determining an appropriate tip speed for a particular vessel and agitator, a person skilled in the art would not find the term "about 600 cm/sec" to be unclear.

F. *Inventors*

ADM contends that the patent should be found invalid under 35 U.S.C. §§ 102(f), 111, 115 and 116 for failure to list all of the true inventors.

In his notes, Edwards had recorded that it would not be desirable to operate at tip speeds greater than 60 cm/sec. In their scale up work, Froelich of CPC and Wolf of Swenson determined that Edwards had been incorrect in

finding that 60 cm/sec. was the upper limit for an appropriate tip speed and successfully operated their larger crystallizer at tip speeds of 516, 548 and 558 cm/sec. At Froelich's suggestion, CPC corrected Edwards' error in preparing the draft patent application.

Froelich and Wolf did not participate in the conception of Edward's invention, nor could they claim to have previously conceived the subject matter of the patent. Rather, their contribution to the work was in demonstrating how Edwards' invention could be implemented. It was in making that contribution that they discovered a conceptual error in Edwards' description of his invention. That was not a discovery worthy of inventorship and is not a reason to find the patent invalid for a failure to list them as the true inventors.

III. *Unenforceability*

A. *Disclosure of Prior Art*

ADM argues that the Court should find the '172 patent invalid based on CPC's failure to disclose material prior art to the patent office during the prosecution of the '172 patent application. ADM reports that the Ganiaris U.S. Pat. No. 3,506,486 issued April 14, 1970 (DTX-87) and Kingma U.S. Pat. No. 3,709,731 issued January 9, 1973 (DTX-23) were material as they involved tip speeds in the range of 62 and 84 cm/sec. and that a 1951 article by McCabe and Stevens taught the very principle CPC claims as Edwards' contribution to the '172 patent.

Ganiaris and Kingma were addressed to the continuous crystallization of dextrose. While CPC knew of these patents prior to filing the application it did not disclose them to the examiner. Nevertheless, it appears that the relevant teachings in these patents were disclosed in the Idaszak patents which were considered by the examiner. Identifying Ganiaris and Kingma to the examiner consequently would have been cumulative.

McCabe and Stevens' 1951 article in Chemical Engineering Progress is titled "Rate of Growth of Crystals in Aqueous Solutions." The authors report on their analysis of crystal growth in an agitated solution and their conclusions that the growth process consists of a mass transfer of solute to the solution-crystal interface followed by an interfacial reaction, and that in industrial crystallizers the growth rate will be a function of crystal size and the growth of larger crystals will be favored. As noted above, ADM has shown that CPC was aware of this article at the time it prepared the patent application. The Court finds, however, that ADM has failed to establish that CPC knew the article was material or that CPC acted with an intent to deceive in failing to bring the article to the attention of the Patent and Trademark Office.

B. *Misrepresentations*

ADM argues that the Court should find the patent invalid based on CPC's alleged misrepresentations and omissions of fact in the information it submitted to the Patent Office. For example, in its patent application, CPC reported that "[T]hrough further testing . . . it has been found that tip speeds in the range of 300-600 cm/sec offer a reasonable compromise with regard to growth rate, nucleation rate, and cost-efficient mechanical agitation design." ADM contents this was a misrepresentation of fact, as CPC did not perform tests of its Swenson work at tip speeds in the range of 300 to 600 cm/sec. In addition, ADM contends that CPC wrongfully failed to disclose Edward's conclusion that tip speeds above 60 cm/sec. were not desirable. ADM has also argued Edwards incorporated certain mistakes in the summaries of his work.

Having reviewed these matters, and without taking the time to speak to the facts as to each issue, the Court finds ADM has failed to identify a sufficient factual basis to warrant declaring the patent invalid based on alleged misrepresentations to the Patent Office.

C. *Award Of Attorneys Fees and Expenses Under 35 U.S.C. Sec. 285.*

Finally, ADM seeks an award of attorney's fees pursuant to 35 U.S.C. § 285, based on CPC's inequitable conduct during the prosecution of the patent and as ADM contends CPC brought this action in bad faith. The Court finds ADM has failed to establish a factual basis for finding there are exceptional circumstances in this case that would justify ordering CPC to pay ADM's fees in this case.

CONCLUSION

In conclusion, the Court finds United States Patent 4,357,172 invalid and will enter judgment in favor of Archer Daniels Midland Company and against CPC International on the claims in CPC's complaint.